[Bulletins 223 to 234 constitute the Report for 1914. In binding, pages i-xvi at the end of this bulletin should be detached and placed before Bulletin 223 which begins with page 1]

Maine Agricultural Experiment Station

BULLETIN No. 234. **DECEMBER, 1914.**

FINANCES, METEOROLOGY, INDEX.

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AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE.

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BULLETIN 234.

ABSTRACTS OF PAPERS PUBLISHED BY THE STATION IN 1915 BUT NOT INCLUDED IN THE BULLETINS.

A complete list of all the publications issued by and from the Station in 1914 are given on pages IX to XI of the introduction to this Report. The following pages contain abstracts of the papers issued during the year that are not included in the Bulletins or Official Inspections for the year.

Some Physiological Observations Regarding Plumage Patterns.*

This study was undertaken with the object of carrying the analysis of the genetic factors for color pattern somewhat farther than has hitherto been done. In many forms of domestic poultry the plumage of particular parts of the body displays on each feather a definite and regular pattern. Experimental studies show that these patterns are inherited in a clean-cut Mendelian manner. In the case of the Barred Plymouth Rock color pattern, which has been more thoroughly studied in regard to its inheritance than any other single plumage pattern in birds, extensive investigations in this laboratory and elsewhere indicate that this barred pattern is represented in the gametes by a single Mendelian factor or gene. The manner in which this gene operates physiologically presents a problem of great interest, since it involves an element of morphogenetic localization.

With a view of getting further light on this matter a study has been made of the successive regeneration of feathers, in which special attention has been paid to the comparison of the pattern shown in the regenerates and in the original feather.

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*This is an abstract of a paper with the same title by Raymond Pearl and Alice M. Boring published in Science, N. S., Vol. XXXIX, No. 995, pp. 143-144, January 23, 1914.

A few of the more important results which have been obtained from this study, which has now been in progress about a year and a half, may be here set forth, as follows:

1. All feather follicles are not capable of continually producing successive feathers for an indefinite time. In the case of the general body plumage a feather is usually not regenerated more than about three times. The precise number of successive regenerations varies with different birds and different feathers. Wing primaries seem to possess the maximum regenerative capacity. After about the third removal in the case of body feathers the follicle usually remains in a perfectly quiescent condition, taking no steps whatever toward the regeneration of a new feather.

2. This failure to regenerate is, however, very definitely related to the natural moult of the bird, and in the following way. A follicle which has been absolutely inactive for a long period of time (e. g., six months) preceding the natural autumn moult of the bird produces a new feather in connection with the moult, in the same manner as does any other follicle of the body. In other words the process of natural moulting reactivates the follicle which has been brought into a quiescent state by successive feather removal.

3. The precise pattern exhibited by a particular feather is, in the usual course of events, reproduced each time a feather is produced by that follicle with extreme fidelity of detail. If, however, the feather is removed from the follicle as soon as it is fully grown, thus forcing continued regenerative activity of the follicle, the pattern tends progressively to be broken up, and probably will ultimately be entirely lost as a definite pattern. A progressive breaking up of an originally definite pattern is clearly shown in a number of cases. The behavior of the color pattern in successively regenerated feathers suggests, as a working hypothesis, that the pattern factor or gene is possibly represented in each follicle by a strictly limited amount of material, and that when this is used up the pattern is lost.

4. The secondary sexual feathers of the male, such as the saddle hangers, only appear as adult plumage. The same follicles which bear these feathers produce, as juvenile plumage, undifferentiated body feathers. The formation of these secon-

dary sexual feathers is not necessarily dependent upon any normal moult. If the juvenile feather is removed from the follicle the next feather produced by that follicle will be the secondary sexual feather, and not a feather of the juvenile type. After that all further regenerations are of the sexually differentiated feather.

The Measurement of Changes in the Rate of Fecundity of the Individual Fowl.*

The purpose of this note is to call attention to a method of measuring and representing graphically changes in the intensity of ovarian activity, as indicated by rate of ovulation, in the domestic fowl. It has been fully established that if one considers the egg production records from a group or flock of hens as a whole there are observable regular and distinct cycles in the production. Thus, we have distinguished in former publications between winter, spring and summer cycles of flock production. It has not hitherto been possible to observe precisely or to measure any such cyclical changes (either of long or short period) in the egg production of a single individual bird, owing to the fact that the production is in discrete units. Yet while the end products of ovarian activity are discrete units there are very strong reasons for supposing that physiologically the elaboration—or production in the broad sense—of eggs by the ovary is a continuous process of secularly changing rate, rather than a truly discontinuous process.

By a simple statistical expedient it is possible to represent the changes in rate of fecundity in an individual bird as a continuous curve, of which the ordinates represent the rates of egg production on a percentage scale (0 to 100) at the time interval plotted as abscissae. This is done by taking, as the rate of fecundity for any given day Pn, the percentage which the actual number of eggs laid by the bird during the 21 days of which Pn is the central day, is of 21. Put as a formula, if

Rp_n = rate of fecundity (or ovarian activity as indicated by ovulation) on the day P_n

*This is an abstract of a paper by Raymond Pearl having the same title published in Science, N. S., Vol. XL, pp. 383-384.

1 = an egg produced,
and Σ denotes summation between the indicated limits we have

$$Rp_n = 100 \frac{(\Sigma_{P_n - 10}^{P_n + 10} 1)}{21}$$

The rates so calculated for each successive day may be plotted as a curve.

Applying this method to records of one, two and three year old hens many interesting and novel points regarding ovarian activity, as expressed in ovulation, may be made out. The long period secular cycles of production appear much more clearly and precisely than in flock mass statistics. The steady diminution in maximum rate of fecundity per unit of time after the first spring cycle in the bird's life is very strikingly shown in the great majority of cases.

Studies on the Physiology of Reproduction in the Domestic Fowl. VII. Data Regarding the Brooding Instinct in Relation to Egg Production.*

This paper presents data regarding variations in the manifestations of the brooding instinct in fowls. It is shown that:

1. Broodiness normally constitutes one element in the cyclical reproductive activities of the female. It recurs with greater or less regularity following periods of laying.

2. The degree of intensity of the brooding instinct, both in respect of its objective manifestations and in respect of its physiological basis, may vary considerably at different times in the life of the same individual.

3. Broodiness in the domestic fowl is not necessarily connected with any particular season. It may occur entirely outside the regular breeding season.

4. While ordinarily broodiness is preceded by the laying of a "clutch" of eggs, this need not necessarily be so. Cases are cited in which well marked broodiness occurs without antecedent laying.

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*This is an abstract of a paper bearing the same title by Raymond Pearl published in the Journal of Animal Behavior, Vol. 4, pp. 266-188.

5. Well marked broodiness behavior may in certain cases disappear very quickly.

6. The manifestations of the brooding instinct are apparently closely connected with the functional activity of the ovary, though the precise nature of the connection has not yet been analyzed.

Studies on the Physiology of Reproduction in the Domestic Fowl. viii. on some Physiological Effects of Ligation, Section or Removal of the Oviduct.*

This paper describes the results of various surgical interferences with the egg-producing mechanism of the fowl, undertaken for the purpose of getting more light on the normal physiology of the organs concerned.

The chief results obtained are:

1. Neither the ligation, section, nor entire removal of the oviduct causes the degeneration or prevents the further growth of the ovary.

2. The pressure of the enclosing funnel is evidently not necessary to ovulation since yolks are ovulated into the body cavity after the *ostium* is sewed or ligated or after the entire duct is removed.

3. Internal pressure due to continued yolk formation is probably the most important factor in the normal rupture of the follicle, since closing the funnel or removing the duct apparently does not greatly delay ovulation.

4. There are cases of unoperated birds with normally functioning ovaries, and oviducts apparently capable of functioning, which do not produce eggs because of some anatomical or physiological condition of the mouth of the oviduct which prevents the entrance of the yolk.

5. The fate of yolks or eggs set free in the body cavity depends apparently upon the physiological vigor of the bird. First, they may cause serious metabolic disturbances which result in the death of the bird; second, they may be absorbed rapidly from the general peritoneal surface; or third, they may be walled off by peritoneum and then absorbed.

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*This is an abstract of a paper bearing the same title by Raymond Pearl and Alice M. Boring, which was published in the Journal of Experimental Zoölogy, Vol. 17, No. 3, pp. 395-424.

6. The material from the resorbed yolks or eggs is apparently utilized in body metabolism since all such birds which were in good health at the time of autopsy were very fat.

7. The removal of the greater portion of an oviduct does not cause the atrophy of any remaining portion.

8. The whole or any remaining part of an oviduct sewed at the funnel, ligated at any level, or with parts removed, passes through growth and cyclic changes coördinated with changes in the ovary exactly as an unoperated duct.

9. The stimulation of the advancing egg is necessary for the discharge of the secretion of the duct, since a duct closed at any level functions only to the point where the passage is interrupted.

10. When any portion of the ventral ligament is removed it is not replaced but all remaining portions develop.

11. The forward portion of the ventral ligament is necessary for the reception of the yolk by the funnel.

12. The muscle bundles which arise from the muscular cord in the ventral ligament along the uterus are probably an important part of the normal apparatus which expels the egg.

Studies on the Physiology of Reproduction in the Domestic Fowl. IX. On the Effect of Corpus Luteum Substance upon Ovulation in the Fowl.*

In this paper it is shown that the dessicated fat-free substance of the corpus luteum of the cow, when injected in suspension, in proper dosage, into an actively laying fowl immediately inhibits ovulation. The duration of this effect varies with different birds from a few days up to two to three weeks. After the bird begins ovulating again the laying goes on unimpaired. The same effect is produced by the injection of extracts of the lutear substance, either intravenously or intra-abdominally. The active substance in producing the inhibition is inactivated by boiling.

Further investigation of the subject is in progress.

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*This is an abstract of a paper bearing the same title by Raymond Pearl and Frank M. Surface and published in the Journal of Biological Chemistry, Vol. XIX, No. 2, pp. 263-278.

Studies on the Physiology of Reproduction in the Domestic Fowl. x. Further Data on Somatic and Genetic Sterility.*

This is a study of certain cases of partial or complete sterility in the fowl, having for its object to get further light on the cause of such sterility.

The chief results may be summarized as follows:

1. Birds which are hereditarily high layers may fail to make good performance records because for some anatomical reason it is impossible for yolks to enter the oviduct.

2. Birds which ovulate, or return partly formed eggs, into the body cavity usually show the nesting instinct.

3. The nesting records show a rhythm similar to egg records of normal birds and it seems probable that they are the normal resultant of the ovulation.

4. Data given in this paper justify the following statements.

A. In case of stoppage of the duct at any level the duct on both sides of the point of stoppage passes through the same cyclic changes coördinated with the cyclic changes in the ovary as a normal unobstructed duct. The duct functions only as far as it receives the stimulus of the advancing egg.

B. Absence of pressure from the funnel does not prevent or apparently greatly retard ovulation. Increased internal pressure may therefore be the most important factor in normal ovulation.

C. Yolks of partly or fully formed eggs may be absorbed rapidly and in large numbers from the peritoneal surface without causing any serious derangement of normal metabolic processes.

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*This is an abstract of a paper bearing the same title by Maynie R. Curtis and Raymond Pearl, now in press in the Journal of Experimental Zoölogy.

Studies on Inbreeding. iv. on a General Formula for the Constitution of the *N*th Generation of a Mendelian Population in which all Matings Are of a Brother x Sister.*

In this paper it is shown that if we let

On_{-1} denote the number of AA families in the n—1th generation, and

Pn_{-1} denote the number of $AA+Aa$ families in the n—1th generation, and

Qn_{-1} denote the number of Aa families in the n—1th generation, and

Rn_{-1} denote the number of AA and $2Aa$ and aa families in the n—1th generation, and

Un_{-1} denote the number of $Aa+aa$ families and

Vn_{-1} denote the number of aa families.

Then the families in the nth generation will be given by the following relations of the coefficients.

$$o_n = o_{n-1} + 1/4p_{n-1} + 1/16r_{n-1},$$
$$p_n = 1/2p_{n-1} + 1/4r_{n-1},$$
$$q_n = 1/8r_{n-1},$$
$$r_n = 1/2p_{n-1} + q_{n-1} + 1/4r_{n-1},$$
$$u_n = 1/2u_{n-1} + 1/4r_{n-1} = p_n,$$
$$v_n = v_{n-1} + 1/4u_{n-1} + 1/16r_{n-1} = o_n.$$

Studies on Inbreeding. v. Inbreeding and Relationship Coefficients.**

The object of this paper is to call attention to the fact that inbreeding of considerable degree may exist in the entire absence of any kinship between the two individuals bred together, and to bring forward a method of separately measuring what proportion of the observed inbreeding in a particular case is due to kinship of the parents, and what to earlier ancestral reduplication. A proposed coefficient of relationship is described, and its application illustrated by concrete cases.

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*This is an abstract of a paper bearing the same title by Raymond Pearl, published in the American Naturalist, Vol. XLVIII pp. 401-424.

**This is an abstract of a paper bearing the same title by Raymond Pearl, published in the American Naturalist, Vol. XLVIII. pp. 513-523.

On the Law Relating Milk Flow to Age in Dairy Cattle.†

Before the production records of different cows may be critically compared, as in the study of the inheritance of milk flow, for example, it is necessary to make proper corrections for the differing ages of the individuals compared. It has long been a matter of common knowledge that there is a change in amount of milk produced as a cow grows older. Before any proper corrections for this factor can be applied it is essential to determine with precision, and, so far as may be, generality, the quantitative law connecting these two characters milk flow and age. By the associations and individuals who have in charge the Advanced Registry records in all of the dairy breeds of cattle it is generally, and quite erroneously, assumed that the relation between these two variables is a strictly linear one. The essential result of a detailed study of the problem may be stated as follows: *The amount of milk produced by a cow in a given unit of time (7 days, 1 year, etc.) is a logarithmic function of the age of the cow.*

The actual curves which were found to graduate successfully the non-linear regression lines in the case of the different breeds were of the general form

$$Y = a + bX + cX^2 + d \log X$$

where Y denotes the amount of milk produced in a given time, and X denotes the age of the cow. This form of curve is one with which we are already familiar in connection with studies of growth, the change in size of the hen's egg with age, etc.

The law may be stated verbally in the following way: Milk flow increases with increasing age but at a constantly diminishing rate (the increase in any given time being inversely proportional to the total amount of flow already attained) until a maximum flow is reached. After the age of maximum flow is passed the flow diminishes with advancing age and at an increasing rate. The rate of decrease after the maximum is, on the whole, much slower than the rate of increase preceding the maximum.

In general the law above stated applies to the absolute amount of fat produced in a unit of time as well as to the milk.

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†This is an abstract of a paper bearing the same title by Raymond Pearl, published in the Proceedings of the Society of Experimental Biology and Medicine, Vol. XII, pp. 18-19.

Growth and Variation in Maize.*

This paper gives the results of a study of the growth of the sweet corn plant and the relation of the growth phenomena exhibited to the laws of variation of the plant.

1. Measurements were made at twice-a-week intervals of the height of three series of corn plants. The heights were measured to the tip of the tallest leaf. In addition to these, separate sets of measurements were also made of the tassel height as soon as the tassels appeared.

2. The growth curves obtained by plotting the mean height at each measurement are relatively smooth.

3. After July 3, the time of tasseling, the plants grow in height much faster than before. Growth in height ceases entirely as soon as the tassel blooms.

4. The absolute variability shows a marked increase up to about June 19. From this until the time of tasseling it remains nearly constant but shows a very great increase at the time of tasseling. After all the plants have tasseled the absolute variability decreases somewhat.

5. The relative variability considered for the whole season shows a marked progressive diminution. It thus follows the general growth law of diminishing variability. Considered in detail, however, the relative variability first shows an increase. After June 19 there is a rapid decrease until the time of tasseling. During the period of tasseling there is a very rapid increase in the relative variability. This is followed by an equally rapid decrease. A stable condition is finally reached which is some ten per cent. lower than the variability at the beginning of the season.

6. It is interesting to note that the relation of tasseling to the growth and variability of the height of corn plants is not unlike the relation of puberty to the growth of children. This does not mean that the two processes are necessarily analogous physiologically.

7. From the data presented it appears probable that the corn plant grows in a series of cycles. Each cycle is characterized by the special development of one set of organs. They are,

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*This is an abtsract of a paper with the same title by Raymond Pearl and Frank M. Surface, now in press in Zeitschrift fuer induktive Abstammungs-und Vererbungslehre.

in order, the root cycle, the leaf cycle, the tassel cycle and the ear cycle. The reasons for the postulation of these cycles is given in the text.

8. The observed difference in the manner of growth of individual plants and of groups of plants cannot be explained as the effect of external, environmental factors.

9. These differences are rather to be looked upon as the effect of internal factors.

10. The distribution of the average relative size (mean quintile position) of individual plants is such as to suggest the random distribution of these factors among the plants. The same thing is brought out by the distribution of the relative measurements of plants starting or ending with a given relative size (quintile).

11. The simplest method of explaining these facts is to regard the differences in the manner of growth as due to independent Mendelian factors which are distributed at random in any population of open fertilized maize plants. These factors would occur in the proportions found in a stable Mendelian population mating at random.

12. By assuming the presence of two independent growth factors and weighting each with the proper value, it is possible to obtain a theoretical distribution agreeing very closely with the observed distribution. It is possible that by using more factors even a better fit might be obtained.

13. The interpretation of the growth of these plants by Mendelian factors is strongly supported by the distribution of the standard deviations of the plants with different relative sizes. Thus it has been shown that the extreme plants which would be more nearly homozygous and for this reason less variable are, as a matter of fact, some fifty per cent. less variable than the plants in the middle class after all allowance has been made for the difference in the size of the means.

The Immature Stages of the Tenthredinoidea.*

This study of the immature stages of sawflies was undertaken in the hope that some information might be obtained as to the

*This is an abstract of a paper by Alex. D. MacGillivray with the same title published in the Forty-Fourth Annual Report of the Entomological Society of Ontario, 1913 (1914), pp. 54-75. Plate I with 27 figures.

validity of the species difficult to differentiate from characters of the adults.

The paper begins with a general statement of the classification of the group. The main facts in the development of these insects are then discussed, including the method of reproduction the varied feeding habits of the larvae, the differences in appearance of given species due to molts, and the peculiar preparations of the larvae before pupation.

Descriptions of the larvae of the subfamilies of the group are given, and illustrated by the plate of 27 figures.

A sawfly belongs to the same order of insects as the bees and wasps but instead of having a sting for an ovipositor, its egg laying apparatus is equipped with a small saw with which it cuts a slit in the tissue of the plant and deposits an egg in the opening. The adult or winged sawfly does practically no harm, but the young which hatch from her eggs are as greedy as caterpillars and as completely demolish the foliage they feed upon. These larvae resemble hairless caterpillars somewhat in their appearance as well as in their feeding habits and are frequently mistaken for them.

The eggs are always laid by the female within the tissue of the food plant. Where the larvae are borers, they are laid in holes pierced in the stems of bushy plants or in the limbs or trunks of living or recently dead trees. Where the larvae are leaf-feeders, the eggs are placed in slits sawed by the female from the under surface and located between the two layers of parenchyma. A few species insert their eggs in the petiole of the leaf, some of the gall-making species in the leaf-buds, and one in the blossoms of cherry on the sepals or the upper part of the calyx cup. The eggs are oval in outline, flattened, usually white in color, though sometimes bluish or greenish, and very difficult to locate when first laid. They swell after a short time to twice their original size and push out the surface of the leaf so that it appears to be covered with little mounds.

The manner of feeding is strikingly varied. With many species, the young larvae as soon as they emerge from the egg eat holes through the leaf and continue feeding around the circumference of the hole clinging to the leaf with their thoracic legs and holding the body S-shaped in the hole. Some species are leaf-skeletonizers for the first two or more stages

and then either feed from the edge or eat holes in the leaf. The great majority of species are edge feeders.

The larvae of certain genera and subfamilies of the sawflies are entirely different in appearance during their last larval period; white larvae may become spotted, the spotted change to white or green and the spiny lose their spines. Thus the same specimen may be powdery white one afternoon and the next morning yellow with black spots. These changes which take place at time of molting increase the difficulties of studying a species.

The members of one subfamily feed on various species of conifers; they clasp the needles between the thoracic legs and feed until only short stubs are left. Some species will feed only on the needles of the year old growth, others are indiscriminate, feeding either on the new or the old growth. The pines, spruces, and larches especially suffer from the attack of sawfly larvae in Maine.

A Note on Rhagoletis Pomonella in Blueberries.*

In the spring of 1913 the attention of the Maine Agricultural Experiment Station was called to a certain maggot infesting the blueberries in Washington County; and, accordingly certain observations on this insect were made during the summer. Although the work was merely of a preliminary character, the adult was reared, and when bred, the maggot proved to be *Rhagoletis pomonella* Walsh. This appears to be the first record from the blueberry.

When the maggots are small, an infested berry cannot be distinguished by sight from a sound one, but usually when they have attained a fair size the fruit becomes very much shrivelled and shrunken. At all times, even when the larvae are small, an infested berry can easily be distinguished by the touch, for it feels soft and mushy, and this is the surest external indication that it has been attacked. In an infested berry, the pulp becomes red and stringy. Maggots were found at this time in all stages from very small ones to those fully grown. The maggot appears to become full fed in one berry,

*This is an abstract of a paper with the same title by William C. Woods, published in the Journal of Economic Entomology. Vol. 7, pp. 398-399.

which it leaves by an irregularly shaped exit hole through the skin, in order to pupate in the ground.

List of the Hemiptera-Heteroptera of Maine.*

The present list is the first of a series of papers in preparation on the Heteroptera of New England and is offered as a record of the species definitely known to inhabit Maine. In view of the great extent of almost inaccessible territory in the state and the relatively small amount of collecting which has been done, it is to be expected that additional species will be found, but the list is complete enough to be a useful basis for subsequent work, as it includes records of 175 species.

The records have been compiled chiefly from the following sources: An unpublished list of Maine Hemiptera by Mr. O. O. Stover, whose material was determined in part by Uhler, in part by Professor Osborn; the collection of the Maine Agricultural Experiment Station, determined largely by Mr. E. P. Van Duzee; the collection of Mr. F. A. Eddy of Bangor; the collection of the Boston Society of Natural History; and the collection of Mr. Parshley. The dates given are the earliest and latest found on record for the several species.

Where significant data was available, brief notes follow the name of the species listed, as for example:—

"Family COREIDAE.

Anasa Amyot et Serville.

A. tristis De Geer. 22 June—17 Oct. Orono and numerous other localities.

Corynocoris Mayr.

C. typhaeus Fab. 10 May. Orono.

I took twelve specimens of this species as they flew up, one by one, to the dried body of a long dead fowl. Some alighted nearby and others disappeared within the carcass. I was unable to determine whether they came to feed on the juices of the carrion or to prey on other insects, and they may have been attracted merely by the odor. I believe that there are few if any positive records of the frequenting of carrion by Heteroptera."

*This is an abstract of a paper with the same title by H. M. Parshley, published in Psyche, Vol. 21, pp. 139-149.

METEOROLOGICAL OBSERVATIONS.

For many years the meteorological apparatus was located in the Experiment Station building and the observations were made by members of the Station Staff. June 1, 1911, the meteorological apparatus was removed to Wingate Hall and the observations are in charge of Mr. James S. Stevens, professor of physics in the University of Maine.

In September, 1914, the meteorological apparatus was again moved to Aubert Hall, the present headquarters of the physics department.

The instruments used were at Lat. 44° 54′ 2″ N. Lon. 64° 40′ 5″ W. Elevation 135 feet.

The instruments used are the same as those used in preceding years, and include: Wet and dry bulk thermometers; maximum and minimum thermometers; rain gauge; self-recording anemometer; vane; and barometers. The observations at Orono now form an almost unbroken record of forty-six years.

Meteorological Summary for 1914.

Observations Made at the University of Maine.

1914.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Averages.	Totals.
Highest temperature	47	45	50	75	88	88	89	85	91	78	66	62	.....	.....
Lowest temperature	-22	-24	4	14	27	34	42	38	23	19	6	-17	.....	.....
Mean temperature	16.3	11.9	30.1	40.0	55.8	60.8	65.8	66.0	60.0	50.9	38.3	24.3	43.35	.....
Mean temperature in 46 years	16.51	18.57	28.53	40.95	52.94	62.05	67.17	65.29	57.58	45.66	34.68	22.02	42.66	.....
Total precipitation in inches	4.36	2.52	2.71	4.91	1.58	3.82	2.84	3.05	3.03	3.33	1.69	1.20	.....	35.04
Mean precipitation in 46 years	4.07	3.51	4.19	2.95	3.53	3.41	3.33	3.44	3.49	3.86	3.56	3.51	42.75	.....
Number of days with precipitation of .01 or more	10	7	5	6	3	9	8	7	5	8	6	4	.....	78
Snow fall in inches	20.5	22	5	10	.....	.....	.....	.....	.....	.....	4	5	.....	66.5
Mean snow fall in 46 years	21.97	21.52	15.36	5.46	0.18	.....	.....	.....	.....	0.70	7.03	16.05	88.19	.....
Number of clear days	12	20	8	12	15	20	24	19	21	23	12	18	.....	204
Number of fair days	4	2	9	4	8	4	2	5	4	4	10	8	.....	64
Number of cloudy days	15	6	14	14	8	6	5	7	5	4	8	5	.....	97
Total movement of wind in miles	4367	4332	5264	5746	3246	4348	2777	2703	2237	3906	4882	5101	1067.1	18809

REPORT OF THE TREASURER.

The Station is a department of the University and its accounts are kept in the office of the Treasurer of the University. The books, voucher files, etc., are, however, all distinct from those of the other departments of the University. The classification of accounts is that prescribed by the auditors on the part of the Federal Government, and approved by the State Auditor. All of the accounts are audited by the State Auditor and the Hatch Fund and Adams Fund accounts are also audited by the Office of Experiment Stations acting for the United States Secretary of Agriculture in accordance with Federal Law. The tabulated summaries are given in the tables on the two pages that follow.

REPORT OF TREASURER FOR FISCAL YEAR ENDING JUNE 30, 1914.

Receipts.	Hatch fund.	Adams fund.	Animal husbandry investigations.
Balance July 1, 1913			
Treasurer of United States	15,000 00	$15,000 00	
State			$5,000 00
Sales, etc			2,500 00
Due from State			
Total	$15,000 00	$15,000 00	$7,500 00
Disbursements.			
Salaries	$5,196 03	$11,049 58	$5,692 61
Labor	4,885 64	107 86	
Publications	152 48		
Postage and stationery	525 94	96 85	80 96
Freight and express	226 99	100 78	16 41
Heat, light and power	491 59	105 41	
Chemical and laboratory supplies	345 88	457 96	132 78
Seeds, plants and sundry supplies	129 27	33 17	
Fertilizers	60 83	48 00	
Feeding stuffs	740 18	1,351 95	
Library	807 11	55 09	41 54
Tools, implements and machinery	452 56	318 37	31 44
Furniture and fixtures	182 14	201 04	82 04
Scientific apparatus	82 45	546 05	437 74
Live stock	8 09	20 45	
Traveling expenses	249 92	386 90	30 35
Contingent expenses	20 00		
Buildings	439 90	120 54	90 88
Deficit June 30, 1913			863 25
Total	$15,000 00	$15,000 00	$7,500 00

Note: The accounts do not include the expenditures for printing paid in the State treasurer's office. The appropriation is $4,500.00.

REPORT OF TREASUER FOR FISCAL YEAR ENDING JUNE 30, 1914—Concluded.

Receipts.	Aroostook farm.	General account.	Inspection analysis.*
Balance July 1, 1913			
Bangor and Aroostook Railroad	$1,250 00	$1,483 88	
State			3,837 29
Due from State			2,764 55
Sales, etc		7,051 23	
Deficit	2,605 84		
Total	$3,855 84	$8,535 11	$6,601 84
Disbursements.			
Salaries	$50 00	$2,518 29	$5,551 84
Labor	1,097 04	935 12	
Publications			
Postage and stationery	6 07	126 14	204 77
Freight and express	188 64	139 98	95 74
Heat, light and power		328 20	168 23
Chemical and laboratory supplies	33 92	297 26	478 44
Seeds, plants and sundry supplies	783 75	445 03	25
Fertilizers			
Feeding stuffs	5 40	26 25	
Library			
Tools, implements and machinery	357 57	75 58	
Furniture and fixtures			
Scientific apparatus		19 25	46 19
Live stock	950 00	859 00	
Traveling expenses	72 15	54 92	17 16
Contingent expenses	73 75	351 26	33 13
Buildings	237 75	1,254 16	6 05
Balance June 30, 1914		1,104 67	
Total	$3,855 84	$8,535 11	$6,601 84

*This account covers th. income and expenditures January 1, to June 30, 1914.

INDEX.

THIRTIETH ANNUAL REPORT

OF THE

Maine Agricultural Experiment Station

ORONO, MAINE

1914

STATE OF MAINE

1915.

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE.

Organization January to June, 1914.

THE STATION COUNCIL.

PRESIDENT ROBERT J. ALEY, *President*
DIRECTOR CHARLES D. WOODS, *Secretary*
CHARLES L. JONES, Corinna,
FREELAND JONES, Bangor,
WILLIAM A. MARTIN, Houlton } *Committee of Board of Trustees*
JOHN A. ROBERTS, Norway, *Commissioner of Agriculture*
EUGENE H. LIBBY, Auburn. *State Grange*
HOWARD L. KEYSER, Greene. *State Pomological Society*
RUTILLUS ALDEN, Winthrop, *State Dairymen's Association*
LEONARD C. HOLSTON, Cornish. *Maine Livestock Breeders' Association*
WILLIAM G. HUNTON, Readfield. *Maine Seed Improvement Association*

AND THE HEADS AND ASSOCIATES OF STATION DEPARTMENTS, AND THE DEAN OF THE COLLEGE OF AGRICULTURE.

THE STATION STAFF.

ADMINISTRATION	CHARLES D. WOODS, Sc. D.	*Director*
	BLANCHE F. POOLER.	*Clerk*
	GEM M. COOMBS.	*Stenographer*
	JANIE L. FAYLE.	*Stenographer*
BIOLOGY	RAYMOND PEARL, PH. D.,	*Biologist*
	FRANK M. SURFACE, PH. D.,	*Biologist*
	MAYNIE R. CURTIS, PH. D.,	*Assistant*
	CLARENCE W. BARBER, B. S.,	*Assistant*
	JOHN RICE MINER, B. A.,	*Computer*
	HAZEL F. MARINER, B. A.,	*Clerk*
	FRANK TENNEY.	*Poultryman*
CHEMISTRY	JAMES M. BARTLETT, M. S.,	*Chemist*
	HERMAN H. HANSON, M. S.,	*Associate*
	EDWARD E. SAWYER, B. S.,	*Assistant*
	ELMER R. TOBEY, B. S.,	*Assistant*
	HAROLD P. VANNAH, B. A.,	*Assistant*
	HARRY C. ALEXANDER.	*Laboratory Assistant*
ENTOMOLOGY	ALICE W. AVERILL.	*Laboratory Assistant*
	EDITH M. PATCH, PH. D.,	*Entomologist*
PLANT PATHOLOGY	WARNER J. MORSE, PH. D.,	*Pathologist*
	MICHAEL SHAPOVALOV, M. S.,	*Assistant*
	VERNON FOLSOM.	*Laboratory Assistant*
HIGHMOOR FARM	WELLINGTON SINCLAIR.	*Superintendent*
	HAROLD G. GULLIVER, B. A.,	*Scientific Aid*
ROYDEN L. HAMMOND.		*Seed Analyst and Photographer*
CHARLES S. INMAN.		*Assistant*

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, Maine.

Organization July to December, 1914

THE STATION COUNCIL.

PRESIDENT ROBERT J. ALEY,	*President*
DIRECTOR CHARLES D. WOODS,	*Secretary*
CHARLES L. JONES, Corinna,	*Committee of Board of Trustees*
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	JACOB ZINN, D. AGR.,	*Assistant*
	JOHN W. GOWEN, B. S.,	*Assistant*
	JOHN RICE MINER, B. A.,	*Computer*
	HAZEL F. MARINER, B. A.,	*Clerk*
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	EDWARD E. SAWYER, B. S.,	*Assistant*
	ELMER R. TOBEY, B. S.,	*Assistant*
	HOYT D. LUCAS, B. S.,	*Assistant*
	HARRY C. ALEXANDER,	*Laboratory Assistant*
ENTOMOLOGY	EDITH M. PATCH, PH. D.,	*Entomologist*
	ALICE W. AVERILL,	*Laboratory Assistant*
PLANT PATHOLOGY	WARNER J. MORSE, PH. D.,	*Pathologist*
	MICHAEL SHAPOVALOV, M. S.,	*Assistant*
	VERNON FOLSOM,	*Laboratory Assistant*
AROOSTOOK FARM	GUY A. BAKER,	*Superintendent*
HIGHMOOR FARM	WELLINGTON SINCLAIR,	*Superintendent*
ROYDEN L. HAMMOND,		*Seed Analyst and Photographer*
CHARLES S. INMAN,		*Assistant*

*Died November 13, 1914

The publications of this Station will be sent free to any address in Maine. All requests should be sent to

Agricultural Experiment Station,
Orono, Maine.

CONTENTS.

ANNOUNCEMENTS.

Establishment of the Station.

The Maine Fertilizer Control and Agricultural Experiment Station, established by Act of the Legislature approved March 3, 1885, began its work in April of that year in quarters furnished by the College. After the Station had existed for two years, Congress passed what is known as the Hatch Act, establishing agricultural experiment stations in every state. This grant was accepted by the Maine Legislature by an Act approved March 16, 1887, which established the Maine Agricultural Experiment Station as a department of the University. The reorganization was effected in June, 1887, but work was not begun until February 16, 1888. In 1906 Congress passed the Adams Act for the further endowment of the stations established under the Hatch Aact.

The purpose of the experiment stations is defined in the Act of Congress establishing them as follows:

"It shall be the object and duty of said experiment stations to conduct original researches or verify experiments on the physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantage of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manure, natural and artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective states or territories."

The work that the Experiment Station can undertake from the Adams Act fund is more restricted and can "be applied only to paying the necessary expenses for conducting original researches or experiments bearing directly on the agricultural industry of the United States, having due regard to the varying conditions and needs of the respective states and territories."

Investigations.

The Station continues to restrict its work to a few important lines, believing that it is better for the agriculture of the State to study thoroughly a few problems than to spread over the whole field of agricultural science. It has continued to improve its facilities and segregate its work in such a way as to make it an effective agency for research in agriculture. Prominent among the lines of investigation are studies upon the food of man and animals, the diseases of plants and animals, breeding of plants and animals, orchard and field experiments, poultry investigations, and entomological research.

The Legislature of 1913 provided for investigations by the Station in animal husbandry which make Chapter 141 of the Public Laws for 1913. The following quoted from the act outlines the purpose of the act: "The Maine Agricultural Experiment Station in addition to the investigations now conducted by it, shall conduct scientific investigations in animal husbandry, including experiments and observations on dairy cattle and other domestic animals. Said investigations shall be carried out under control of the director of the Maine Agricultural Experiment Station. There shall be appropriated annually from the State Treasury the sum of five thousand dollars to be paid to the Maine Agricultural Experiment Station and the same shall be expended by the director of said Station in executing the provisions of this act."

Inspections.

Up to the close of the year 1913 it had been the duty of the Director of the Station to execute the laws regulating the sale of agricultural seeds, apples, commercial feeding stuffs, commercial fertilizers, drugs, foods, fungicides and insecticides, and the testing of the graduated glassware used by creameries Beginning with January 1914 the purely executive part of these

laws are handled by the Commissioner of Agriculture. The analytical examination of the samples and the publishing the results of the analyses will still be done by the Station. The cost of the inspections is borne by fees and by a state appropriation.

Offices and Laboratories.

The offices, laboratories and poultry plant of the Maine Agricultural Experiment Station are at the University of Maine, Orono. Orono is the freight, express, post, telegraph and telephone address for the offices and laboratories.

Visitors to the Station will find it convenient to leave the steam cars at Bangor or Old Town, as the railway station at Orono is a mile from the University. Bangor and Old Town trolley cars pass through the campus. They pass the railway station in Bangor 5 minutes after the hour and half hour, and the railway station in Old Town, 20 minutes after and 10 minutes before the hour.

Aroostook Farm.

The Legislature of 1913 (Chapter 190 of the Private Laws of 1913) named a committee and appropriated ten thousand dollars for the purpose of purchasing land for a farm for conducting scientific investigations in agriculture in Aroostook County. The law provides that: "The Maine Agricultural Experiment Station shall have the general supervision, management and control of said farm and of all experiments and investigations conducted thereon, and may if it sees fit or deems it best authorize any agent or agents of the United States Department of Agriculture to conduct experiments upon such farm under such terms as it deems best."

The committee on location decided that it would be impracticable to purchase a farm in Aroostook County for the amount named in the act. After several meetings and proposals made from several towns in the county it was decided to purchase a farm at Presque Isle which, with the buildings to be erected upon it will cost $23,000. The farm that was purchased contains about 275 acres, has upon it a large barn with concrete potato house in the basement, a small dwelling house for the

farmer. The erection of a suitable dwelling house for the farm superintendent is provided for by money raised by the citizens of Presque Isle.

The Station came into possession of the farm late in December 1913, and work was begun in the season of 1914.

Highmoor Farm.

Highmoor Farm, purchased by the State for the use of the Station, is located in the town of Monmouth, 2 1-2 miles from the Monmouth station and the same distance from the Leeds Junction station. It is on the Farmington branch of the Maine Central Railroad. A flag station, called Highmoor, is on the farm. Monmouth is the post, telegraph and telephone address for Highmoor Farm. Both Leeds Junction and Monmouth are freight and express addresses.

The Aim of the Station.

Every citizen of Maine concerned in agriculture has the right to apply to the Station for any assistance that comes within its province. It is the wish of the Trustees and Station Council that the Station be as widely useful as its resources will permit.

In addition to its work of investigation, the Station is prepared to make chemical analyses of fertilizers, feeding stuffs, dairy products and other agricultural materials; to test seed- and creamery glassware; to identify grasses, weeds, injurious fungi and insects, etc.; and to give information on agricultural matters of interest and advantage to the citizens of the State.

All work proper to the Experiment Station and of public benefit will be done without charge. Work for the private use of individuals is charged for at the actual cost to the Station. The Station offers to do this work only as a matter of accommodation. Under no condition will the Station undertake analyses, the results of which cannot be published, if they prove of general interest.

Correspondence.

As far as practicable, letters are answered the day they are received. Letters sent to individual officers are liable to remain unanswered, in case the officer addressed is absent. All communications should, therefore, be addressed to the Director or to the

Agricultural Experiment Station,
Orono, Maine.

Publications.

The Station is organized so that the work of investigation is distinct from the work of inspection. The results of investigation are published in the bulletins of the Station. These make up the annual report for the year. The results of the work of inspection are printed in publications known as Official Inspections. These are paged independently of the bulletins and are bound in with the annual report as an appendix thereto. Miscellaneous publications consisting of newspaper notices of bulletins, newspaper bulletins and circulars which are not paged consecutively and for the most part are not included in the annual report are issued during the year.

All the bulletins issued by the Station are sent to the names upon the official mailing list prepared by the Office of Experiment Stations, to all newspapers in Maine and to libraries and to agricultural exchanges. Bulletins which have to do with general agriculture and the Official Inspections which bear upon the feeding stuffs, fertilizer and seed inspections are sent to a general mailing list composed chiefly of farmers within the State. The publications having to do with the food and drug inspection are sent to a special list including all dealers in Maine and other citizens who request them. The annual report is sent to directors of experiment stations and to libraries. Copies of all publications are sent to the newspapers within the State and to the press on the exchange list outside of the State.

BULLETINS ISSUED IN 1914.

No. 223. Spraying Experiments and Apple Diseases in 1913. 24 pages.

No. 224. Field Experiments. 24 pages.

No. 225. Currant and Gooseberry Aphids in Maine. 12 pages, 41 illustrations.

No. 226. Notes on the Accuracy of Bushel Weight Determinations. Note on the Influence of Shape and Size of Plots in Tests of Varieties of Grain. Table for Estimating the Probable Significance of Statistical Constants. 20 pages.

No. 227. Powdery Scab of Potatoes. 16 pages, 9 illustrations.

No. 228. Factors influencing the Size, Shape and Physical Constitution of the Egg of the Domestic Fowl. 32 pages.

No. 229. Studies on Oat Breeding. I. Variety Tests 1910-1913. 56 pages, 8 illustrations.

No. 230. The Rhizoctonia Disease of Potatoes. 24 pages, 13 illustrations.

No. 231. Improving Egg Production by Breeding. 20 pages, 3 illustrations.
No. 232. Histological Basis of Shank Colors in Domestic Fowl. 16 pages, 12 illustrations.
No. 233. Maine Aphids of the Rose Family. 30 pages, 11 illustrations.
No. 234. Meteorology, Finances and Index. 40 pages.

OFFICIAL INSPECTIONS ISSUED IN 1914.

No. 56. Carbonated and Other Beverages. 12 pages.
No. 57. Ice Cream. 8 pages.
No. 58. Butter. 12 pages.
No. 59. Molasses. 8 pages.
No. 60. Feed Inspection. 48 pages.
No. 61. Drugs. 16 pages.
No. 62. Fertilizer Inspection. 36 pages.
No. 63. Ice Cream. 12 pages.
No. 64. Seed Inspection. 12 pages.
No. 65. Miscellaneous Food Materials. 12 pages.

MISCELLANEOUS PUBLICATIONS ISSUED IN 1914.

No. 492. Special Report to Commissioner of Agriculture for 1913. 48 pages.
No. 493. Experiments at Highmoor Farm, 1914. 8 pages.
No. 494. Newspaper Notice Bulletin 227. 1 page
No. 495. Abstract Bulletin 228. 5 pages.
No. 496. Abstract Bulletin 229. 6 pages.
No. 497. Plant Lice of Currant and Gooseberry Bushes 6 pages, 4 illustrations.
No. 498. Abstract Bulletin 230. 4 pages.
No. 499. Abstract Bulletin 232. 4 pages.
No. 500. Record blank for dairy cattle. 2 pages.
No. 501. Plum and Cherry Aphids. 4 pages.
No. 502. Practical Suggestions Regarding the Growing of Sweet Corn 8 pages.
No. 503. Report of Progress in Animal Husbandry Investigations in 1914. 11 pages.

BIOLOGY PUBLICATIONS 1914.

In the numbered series of "Papers from the Biological Laboratory:"
60. Some Physiological Observations Regarding Plumage Patterns. By Raymond Pearl and Alice M. Boring, Science, N. S., Vol. 39, pp. 143-144, 1914.
61. Note on the Accuracy of Bushel Weight Determinations. By Clarence W. Barber, Maine Agricultural Experiment Station Annual Report for 1914, pp. 60-75.

62. Note on the Influence of Shape and Size of Plots in Tests of Varieties of Grain. By Clarence W. Barber. Maine Agricultural Experiment Station Report for 1914, pp. 76-84.

63. A Table for Estimating the Probable Significance of Statistical Constants. By Raymond Pearl and John Rice Miner. Maine Agricultural Experiment Station Annual Report for 1914, pp. 85-88.

64. Growth and Variation in Maize. By Raymond Pearl and Frank M. Surface. Zeitschrift f. ind. Abstammungs-u. Vererbungslehre. (In press).

65. Studies on the Physiology of Reproduction in the Domestic Fowl. VII. Data regarding the brooding instinct in its relation to egg production. By Raymond Pearl. Journal Animal Behavior, Vol. 4 No. 4, pp. 266-268.

66. Studies on Inbreeding. IV. On a general formula for the constitution of the nth generation of a Mendelian population in which all matings are of brother x sister. By Raymond Pearl. American Naturalist Vol. XLVIII, pp. 491-494.

67. Studies on Oat Breeding. I. Variety tests 1910-1913. By Frank M. Surface and Clarence W. Barber. Maine Agricultural Experiment Station Annual Report for 1914, pp. 137-192.

68. Studies on the Physiology of Reproduction in the Domestic Fowl. VIII. On some physiological effects of ligation, section or removal of the oviduct. By Raymond Pearl and Maynie R. Curtis. Jour. Exp. Zoöl., Vol. 17, No. 3, pp. 395-424.

69. Studies on Inbreeding. V. Inbreeding and relationship coefficients. By Raymond Pearl. American Naturalist, Vol. XLVIII, No. 573, pp. 513-523.

70. The Measurement of Changes in the Rate of Fecundity of the Individual Fowl. By Raymond Pearl. Science, N. S., Vol. XL, No. 1028, pp. 383-384.

71. Studies on the Physiology of Reproduction in the Domestic Fowl. IX. On the effect of corpus luteum substance upon ovulation in the fowl. By Raymond Pearl. Journal Biological Chemistry, Vol. XIX, No. 2, pp. 263-278.

72. The Histological Basis of the Different Shank Colors in the Domestic Fowl. By H. R. Barrows. Maine Agricultural Experiment Station Annual Report for 1914, pp. 237-252.

73. Studies on the Physiology of Reproduction in the Domestic Fowl. X. Further Data on somatic and genetic sterility. By Raymond Pearl and Maynie R. Curtis. Journal Experimental Zoölogy. (In press).

74. On the Law Relating Milk Flow to Age in Dairy Cattle. By Raymond Pearl. Proc. Soc. Exper. Biol. and Med. Vol. XXI, pp. 18-19.

Papers published but not in the numbered series.

a. The Service and Importance of Statistics to Biology. By Raymond Pearl. Quarterly Publication of American Statistical Society. March 1914, pp. 40-48.

b. Factors Influencing the Size, Shape and Physical Constitution of the Egg of the Domestic Fowl. By Maynie R. Curtis. Maine Agricultural Experiment Station Annual Report for 1914, pp. 105-136.

c. An Important Contribution to Statistical Theory. By Raymond Pearl. American Naturalist, Vol. XLVIII, pp. 505-507.

d. A Jersey Landmark Gone. By Raymond Pearl. Hoard's Dairyman. Vol. XLVIII, p. 144.

e. Improving Egg Production by Breeding. By Raymond Pearl. Maine Agricultural Experiment Station Bulletin 231, pp. 218-236.

ENTOMOLOGICAL PAPERS FROM THE MAINE AGRICULTURAL EXPERIMENT STATION, 1914.

Ent. 70. The Immature Stages of the Tenthredinoidea. By Prof. Alex. D. MacGillivray. Extract from the Forty-Fourth Annual Report of the Entomological Society of Ontario, 1913 (1914)

Ent. 71. Currant & Gooseberry Aphids in Maine.

Ent. 72. Food Plant Catalogue of the Aphidae of the World. Part IV. By Edith M. Patch. Bul. 225, Mr. Agr. Exp. Station.

Ent. 73. A Note on Rhagoletis pomonella in Blueberries. By William C. Woods. Journal of Economic Entomology, Vol. 7, No. 5

Ent. 74. List of the Hemiptera-Heteraptera of Maine. By H. M Parshley. Psyche, Vol. XXI No. 5.

Ent. 75. A Note on a Parasite of Rhagoletis pomonella. By William C. Woods. In press with The Canadian Entomologist.

Ent. 76. Two Clover Aphids. By Edith M. Patch. In press with Journal of Agricultural Research.

Ent. 77. Maine Aphids of the Rose Family. By Edith M. Patch. Bul 233. Me. Agr. Exp. Station.

Ent. 78. Food Plant Catalogue of the Aphidae of the World. Part V. By Edith M. Patch. Submitted to the Journal of Agricultural Research for a supplement.

CHANGES IN MEMBERS OF COUNCIL.

At the November, 1913 meeting of the State Pomological Society Mr. Howard L. Keyser of Greene was elected a member of the Council in place of Mr. Robert H. Gardiner of Gardiner.

At its annual meeting the Maine Livestock Breeders Association elected Mr. Leonard C. Holston of Cornish as their representative on the Council in place of Mr. William H. Davis of Augusta.

Hon. Rutillus Alden who was a Trustee member of the Station Council for the years 1888-1894 and who represented the Maine State Dairymen's Association on the Council since 1902 died at his home in Winthrop, November 13, 1914. With his long service, his very active interest in agriculture, his genuine sympathy with and keen appreciation of the value of science as applied to agricultural problems his death is a great loss to the Station as well as to the agriculture of the State as a whole. At its annual meeting in December 1914 Mr. Frank S. Adams of Bowdoinham was elected by the State Dairymen's Association a member of the Council in Mr. Alden's stead.

CHANGES IN STATION STAFF.

July 1, Mr. Clarence W. Barber resigned from the Station Staff but is still connected with the University as Farm Demonstrator for Cumberland County.

July 1, Mr. Harold Gulliver resigned as Scientific Aid at Highmoor Farm.

July 1, Mr. Harold P. Vannah resigned his position of Assistant Chemist to take a commercial position.

September 1, Mr. Frank Tenney resigned as poultryman.

April 1, Mr. Guy A. Baker of Presque Isle was appointed Superintendent of Aroostook Farm.

July 15, Jacob Zinn, D. Agr., (Hochschule für Bodenkultur, Vienna, Austria 1914) and August 1, Mr. John W. Gowen, B. S. (University of Maine 1914) were appointed Assistant Biologists.

September 1, Mr. Hoyt D. Lucas, B. S. (Massachusetts Agricultural College 1914) was appointed Assistant Chemist.

Buildings and Equipment.

A new eight room house costing about $3500 was erected on Aroostook Farm during the summer of 1914.

The small farm house of little value at Aroostook Farm burned in July, 1914.

Repairs at the cost of about $250 were made on the barn and potato storage at Aroostook Farm. Large platform scales were placed in the barn and farm machinery and implements to the value of about $3000 were installed. The house and barn were wired for electric lighting, and electric power for threshing, etc., was introduced into the barn.

At a cost of nearly a thousand dollars all of the pastures at Highmoor Farm have been enclosed with a very heavy 58 inch dog and man proof wire fence. Two summer shelters for sheep have been built in the pastures and the old barn and part of the former manure shed have been fitted for winter quarters for sheep. At the April meeting the Council authorized the Director to purchase about 100 sheep with the object of finding out whether sheep without any fancy breeding, kept merely for meat and wool, can be profitably carried under present conditions on Maine farms. It is proposed to continue this test for at least five years.

The inventory July 1, 1914, showed an increase over that of July 1, 1913, in land and buildings of $10,000 and equipment of $10,500.